

WHAT IS CLAIMED IS:

1. A steering angle detection device for an electric power steering apparatus in which a steering wheel shaft coupled to a steering wheel, the steering wheel being capable of multiple rotations to left and right, respectively, from a straight ahead position, is coupled to a steered vehicle wheel via a steering gear having a reduction ratio that varies in accordance with a steering angle of the steering wheel from the straight ahead position, and in which a transmission mechanism couples an electric motor that imparts assistance force corresponding to a steering torque to an output member of the steering gear, comprising:

 - a first resolver and a second resolver which detect a rotation angle of the steering wheel shaft and which have mutually different pole pair numbers;
 - a third resolver that detects a motor rotation angle that is a rotation angle of an output shaft of the electric motor;
 - a steering wheel shaft rotation angle calculation unit that calculates a steering wheel shaft rotation angle that is a rotation angle of the steering wheel shaft within a single rotation thereof, based upon respective detection signals from the first resolver and the second resolver;
 - a differential calculation unit that calculates a first derivative and a second derivative of the motor rotation angle with respect to the steering wheel shaft rotation angle during rotation of the steering wheel shaft;
 - a steering wheel shaft rotation number calculation unit that derives a rotation direction and a rotation number of the steering wheel shaft from a neutral position based on the first derivative and a positive-negative sign of the second derivative ; and
 - a steering angle calculation unit that calculates the steering angle of the steering wheel based on the rotation direction and the rotation number of the steering wheel shaft from the neutral position, and the steering wheel shaft rotation angle.
2. The steering angle detection device for an electric power steering apparatus according to claim 1, wherein

 - the steering wheel shaft rotation number calculation unit stores one of a design value and a measurement value of the first derivative with respect to the steering angle of the steering wheel in a memory unit as one of a map and a

calculation formula, and derives the rotation direction and the rotation number of the steering wheel shaft from the neutral position based on the first derivative and the positive-negative sign of the second derivative, using one of the map and the calculation formula.

5

3. The steering angle detection device for an electric power steering apparatus according to claim 1, wherein

the first resolver and the second resolver detect a rotation angle of a first shaft of a torque sensor coupled to the steering wheel shaft,

10

the second resolver detects a rotation angle of a second shaft of the torque sensor, the second shaft being coupled to the first shaft via a torsion bar,

the steering gear is configured from a variable ratio rack-and-pinion mechanism in which a specific stroke that is a first derivative of a movement amount of a rack shaft with respect to a rotation angle of a pinion varies in accordance with movement of the rack shaft to left and right from a central position,

15

the transmission mechanism is configured such that the output shaft of the electric motor is rotationally coupled to a nut that is screwed to a ball screw provided on the rack shaft, and

the third resolver detects the rotation angle of the output shaft of the electric motor.

20

4. The steering angle detection device for an electric power steering apparatus according to claim 2, wherein

the first resolver and the second resolver detect a rotation angle of a first shaft of a torque sensor coupled to the steering wheel shaft,

25

the second resolver detects a rotation angle of a second shaft of the torque sensor, the second shaft being coupled to the first shaft via a torsion bar,

the steering gear is configured from a variable ratio rack-and-pinion mechanism in which a specific stroke that is a first derivative of a movement amount of a rack shaft with respect to a rotation angle of a pinion varies in accordance with movement of the rack shaft to left and right from a central position,

30

the transmission mechanism is configured such that the output shaft of the electric motor is rotationally coupled to a nut that is screwed to a ball screw provided on the rack shaft, and

the third resolver detects the rotation angle of the output shaft of the electric motor.